



High Performance Computing Software

JPL Internal Seminar Series

Topology, Bandwidth, and Scalability of Communications Fabrics

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Thursday, January 30, 2003

12:00 noon – 1:00 p.m.

Building 126, Room 225

Why do most existing high-end computers perform so poorly? Why does NEC's Earth Simulator Computer perform so well? The simple answer is that the Earth Simulator was designed to meet its performance point; this contrasts with the usual approach of designing for a lower performance point and then scaling up as the machine architecture gains acceptance. Why, then, do HEC architectures scale so poorly? The answer must lie in performance limitations imposed by the network fabric.

This talk will focus on analytic models of communications patterns—nearest neighbor or random—as applied to selected communications architectures: hypercube, fixed dimension mesh or cube, and tree/butterfly networks. Nearest neighbor communications performance scales readily with linearly increasing system-wide bandwidths, but random node-to-node communications performance does not and requires a nonlinear increase in system bandwidth. An interesting conclusion is that the hypercube is a fundamentally scalable network architecture, but fixed-dimension meshes and tree/butterfly networks are not.

For questions, please contact Hans Zima at 4-8980.